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Mechanism of seedlessness in a new lemon cultivar 'Xiangshui' (*Citrus limon*)

Zhang S.-W., Huang G.H., Ding F., He X.-H., and Pan J.C.

Agricultural College of Guangxi University, P.R.China. honest66222@163.com

Seedlessness is an important economic trait of lemon. Pollen and embryo sac fertility, embryo development, compatibility of self-pollinated 'Xiangshui' lemon and cross-pollinated 'Xiangshui' lemon were studied for investigating mechanism of seedlessness in 'Xiangshui' lemon. The results showed that the fertility of pollen and mature embryo sac was normal. The development of embryo sacs belonged to polygonum type. The mature embryo sac had one egg, two synergids, three antipodal cells and one big central cell containing two polar nuclei. Pollen tube in self- or cross-pollination grew well in stigma. Pollen tube of cross-pollinated 'Xiangshui' lemon could grow normally in style and ovary, and then entered into the embryo sac, double fertilization was accompanied. However, the growth of pollen tube in self-pollination was finally stopped in the bottom of stigma. Embryonic development in cross-pollination was normal. Zygote began to divide 2 weeks after cross-pollination (WACP). Early globular embryos were observed 3 WACP. Globular embryos and heart-shaped embryos were observed 4 WACP. Torpedo-shaped embryos were observed 5 WACP. Cotyledonary embryos were observed 6 WACP and developed into complete seeds. While in self-pollination, ovules began to abort at 2 weeks after self-pollination (WASP), disappeared 5 WASP later and produced seedless fruits. The emasculated flowers without any pollination finally developed into seedless fruits also. Results indicated that parthenocarpy is contributed to seedlessness. However, gametophytic self-incompatibility has a main role in seedlessness of 'Xiangshui' lemon by blocking fertilization in the bottom of stigma.

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Differences in the genetic structure of citrus triploid hybrids recovered from 2x X 2x and 4x X 2x sexual hybridisations

Aleza P.[1], Cuenca J.[1], Juárez J.[1], Ollitrault P.[2], and Navarro L.[1]

[1]Instituto Valenciano de Investigaciones Agrarias (IVIA), Centro de Protección Vegetal y Biotecnología, Spain; and [2]Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), BIOS, France. aleza@ivia.es

Citrus triploid hybrids can be recovered by 2x X 2x hybridisations as a consequence of the formation of 2n gametes or by interploid hybridisation. Most of the 4x parents used in our program are doubled-diploid (DD), also known as autotetraploid. The genetic structure of diploid gametes and particularly the rate of parental heterozygosity restitution (PHR) depend on the meiotic process by which they were originated. Second-division restitution (SDR) is the 2n gamete formation mechanism involved in 'Fortune' and clementines. With SDR, PHR is positively linked with the distance of each locus to the centromere. With DD parents, PHR depends on the rate of preferential pairing and thus the proportion of disomic versus tetrasomic segregations. We have compared the genetic structure of two populations of diploid gametes of clementine (one population of 2n gametes and one of 2x gametes produced by DD) with SNP and SSR markers covering the 9 citrus chromosomes. The DD displays mostly tetrasomic segregation; however three linkage groups present intermediate segregation and one displays a tendency for disomy. The PHR in the 2n gametes is 2/3 of that obtained in 2x gametes produced by DD. The two methods of triploid production appear complementary in terms of genotypic variability. 4x X 2x hybridizations are more efficient than 2x X 2x for developing new cultivars phenotypically closer to the diploid parent of the DD. Conversely, 2x X 2x hybridisations provides a greater opportunity to select innovative products.

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Efficient haploid production on 'Wilking' mandarin by induced gynogenesis

Jedidi E.[1], Kamiri M.[2], Poullet T.[3], Ollitrault P.[3], and Froelicher Y.[3]

[1]Tunisian National Agronomic Research Institute (INRAT), Horticultural Laboratory, Tunisia; [2]Groupe Kabbage (DAK), Agadir, Morocco; and [3]International Center for of Agricultural Research for Development (CIRAD), UMR AGAP, France. jedidi.emy@gmail.com

Seedlessness is a major criterion for the citrus fresh fruit market. Therefore, triploid breeding appears very promising for the selection of new citrus cultivars. CIRAD has developed a method to produce triploid hybrids